

(19) World Intellectual Property Organization  
International Bureau



(43) International Publication Date  
11 July 2002 (11.07.2002)

PCT

(10) International Publication Number  
**WO 02/054162 A2**

(51) International Patent Classification<sup>7</sup>: **G05B 19/042**

(74) Agent: **GIAVARINI, Francesco**; ABB Service S.r.l.,  
Viale Edison, 50, I-20099 Sesto San Giovanni (IT).

(21) International Application Number: **PCT/EP01/14984**

(81) Designated States (*national*): AE, AL, AU, BA, BB, BG, BR, CA, CN, CU, CZ, DZ, EE, GD, GE, HR, HU, ID, IL, IN, IS, JP, KP, KR, LC, LK, LR, LT, LV, MG, MK, MN, MW, NO, NZ, PL, RO, SG, SI, SK, UA, US, UZ, VN, YU, ZA.

(22) International Filing Date:  
14 December 2001 (14.12.2001)

(25) Filing Language: English

(84) Designated States (*regional*): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

(26) Publication Language: English

(30) Priority Data:  
MI2000A002851  
28 December 2000 (28.12.2000) IT

(71) Applicant (*for all designated States except US*): **ABB SERVICE S.R.L.** [IT/IT]; Via Arconati, 1, I-20135 Milano (IT).

**Declaration under Rule 4.17:**

— *of inventorship (Rule 4.17(iv)) for US only*

**Published:**

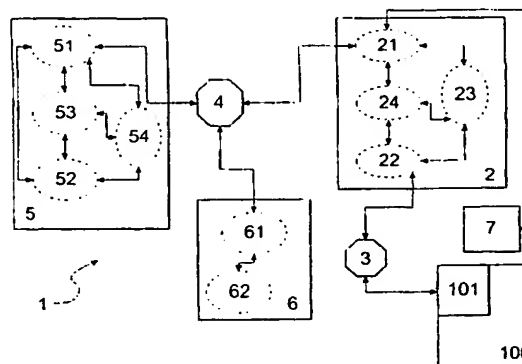
— *without international search report and to be republished upon receipt of that report*

(72) Inventors; and

(75) Inventors/Applicants (*for US only*): **CASSARA', Salvatore** [IT/IT]; Via Martino Anzi, 32, I-22100 Como (IT). **VANINI, Roberto** [IT/IT]; Via Degli Alpini, 20, I-22016 Lenno (IT). **FERRARO, Antonio** [IT/IT]; Via Casanova, 7/A, I-22016 Lenno (IT).

*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

(54) Title: **COMPUTERIZED SYSTEM FOR REMOTE DIAGNOSTICS AND CONFIGURATION ON A FIELD DEVICE**



(57) Abstract: A computerized system for performing remote diagnostics and configuration operations of a field device comprising a control unit, the system comprising: first computerized means, connected to a first communications network and to a second communications network, the first computerized means comprising: a first communications module suitable to automatically handle the remote exchange of data/information with a remote station, by virtue of the first communications network; and a second communications module, linked to the first communications module and suitable to automatically handle the exchange of data/information with the control unit of the field device by virtue of the second communications network; second computerized means, which are connected to the first computerized means and comprise a third communications module suitable to automatically handle the remote exchange of data/information with the first communications module by means of the first communications network; its particularity consisting of the fact that the second computerized means comprise a first diagnostics and configuration module, which is linked to the third communications module and is suitable to remotely and automatically handle, the virtue of the third communications module and the first computerized means, diagnostic operations and/or configuration operations on the control into the field device.

WO 02/054162 A2

# COMPUTERIZED SYSTEM FOR REMOTE DIAGNOSTICS AND CONFIGURATION ON A FIELD DEVICE

## DESCRIPTION

The present invention relates to a computerized system for performing remote  
5 diagnostics and configuration operations on a field device. More particularly,  
the present invention relates to a computerized system that allows to manage  
remotely, automatically and with improved features, the operating life of a field  
device, installed in an industrial system.

It is known that a field device, such as for example a pressure transmitter,  
10 temperature transmitter, and the like, is used in an industrial system to measure  
process values (pressure, temperature and the like). A field device generally  
comprises an electronic control unit for adjusting the operation of the device  
itself and for handling the communication of the field device with external  
electronic devices.

15 It is known that very often a field device, after installation in an industrial  
system, has to be subjected to interventions aimed at ensuring adequate  
management of its operating life in order to ensure optimum performance  
thereof.

Diagnostics operations are often performed with the aim of acquiring  
20 characteristic data/parameters of the field device, whose processing can lead to  
the identification of a fault or malfunction. Moreover, if necessary the  
diagnostics operations are accompanied by configuration operations aimed at  
modifying/improving the setup of the field device in order to solve a fault or  
modify/improve the performance of said device, according to the requirements.

25 In practice, the diagnostics operations consist in providing the control unit of  
the device with data/commands to detect certain physical values of interest,  
while the configuration operations consist in configuring the software/firmware  
of the control unit so as to modify/improve the operating setup of the field

device.

Conventional methods for performing operations for the diagnostics and configuration of a field device generally involve direct intervention on the industrial system in which the field device is installed. Very often these operations are performed by means of the user interface of the control unit of the field device or by virtue of appropriately provided computerized devices that can be connected directly to the control unit of the field device, such as a handheld device or portable computer. Diagnostics and intervention operations are often performed by unspecialized personnel of the user, i.e., the user of the field device, who receives, in order to solve known problems, remote assistance, e.g. by fax, telephone, e-mail, et cetera from the supplier. Alternatively, the user can send the field device directly to the headquarters of the supplier, who performs the required intervention.

Instead, in order to solve more complicated problems, the user can request the field intervention of specialized personnel of the supplier or can acquire specialized personnel, for example trained by the supplier, for maintenance of the field device.

The conventional methods for performing diagnostics and configuration operations on a field device have drawbacks.

Practical experience has shown that very often the interventions performed by unspecialized user personnel are not conclusive, owing to the relatively limited knowledge of the operation of the field device. Remote assistance on the part of the supplier, performed with conventional methods, is highly laborious, since misunderstandings or misinterpretations between the customer and the suppliers can occur often. These problems can arise for example from shortcomings related to the information describing the problem on the part of the customer or from incorrect interpretations of that information by the supplier. Obviously, avoiding these problems sometimes requires considerable coordination efforts

that cause intervention on the field device to be relatively costly in terms of times and expense.

However, practice has shown that the intervention of specialized supplier personnel directly on the field is very often highly expensive for the user, since  
5 the field device is often installed far from the supplier's headquarters. Likewise, it is costly for the user to train and use specialized personnel to be used permanently for the maintenance of installed field devices, especially if the number of these field devices is not particularly large.

The aim of the present invention is to provide a computerized system for  
10 performing diagnostics and configuration operations on a field device that allows to perform remotely and automatically configuration and diagnostics operations on a field device, overcoming the above described drawbacks.

Within the scope of this aim, an object of the present invention is to provide a computerized system for performing diagnostics and configuration on a field  
15 device that allows the supplier, upon simple request by the user, to perform remotely and automatically the diagnostics and configuration operations on a field device in a substantially autonomous manner.

Another object of the present invention is to provide a computerized system for performing diagnostics and configuration on a field device that allows the  
20 supplier to perform remotely and automatically diagnostics configuration operations on a field device, even on a periodic basis.

Another object of the present invention is to provide a computerized system for performing diagnostics and configuration on a field device that allows the supplier to share/exchange with the customer, remotely and automatically,  
25 information/data related to the management of the operating life of the field device.

Another object of the present invention is to provide a computerized system for performing diagnostics and configuration on a field device that allows the

supplier to direct/guide remotely the client in performing particularly complicated diagnostics and configuration operations.

Another object of the present invention is to provide a computerized system for performing diagnostics and configuration on a field device that is highly  
5 reliable, relatively simple to provide, and at modest costs.

This aim and these and other objects that will become apparent hereinafter are achieved by a computerized system for performing the remote diagnostics and configuration of a field device that comprises a control unit. The computerized system according to the present invention comprises first computerized means

10 connected to a first communications network and to a second communications network. Said first computerized means comprise a first communications module suitable to automatically handle the remote exchange of data/information with a remote station, by virtue of said first communications network, and a second communications module, linked to said first

15 communications module and suitable to automatically handle the exchange of data/information with the control unit of said field device by virtue of said second communications network. The computerized system according to the present invention furthermore comprises second computerized means, which are put into communication with said first computerized means by virtue of said

20 first communications network and comprise a third communications module suitable to automatically handle the remote exchange of data/information with said first communications module.

The computerized system according to the present invention is characterized in that said second computerized means comprise a first diagnostics and  
25 configuration module, which is linked to said third communications module and is suitable to remotely and automatically handle, by virtue of said third communications module and said first computerized means, diagnostics operations and/or configuration operations on said field device.

Further characteristics and advantages will become apparent in the following description, which describes some preferred but not exclusive embodiments of the computerized system, with particular reference to the only figure, which is a schematic view of the structure of the computerized system according to the present invention.

With reference to the above cited figure, the computerized system according to the present invention, generally designated by the reference numeral 1, is used to perform the remote configuration and diagnostics of a field device 100 provided with a control unit 101. The computerized system 1 comprises first computerized means 2, which comprise for example a first appropriately configured computer, linked to a first communications network 4 and to a second communications network 3. The first computerized means 2 are connected to the control unit 101 by virtue of a second communications network 3.

The second communications network 3 can be advantageously a field communications network capable of implementing known instrument communications protocols, such as for example HART or FIELDBUS communications protocols.

The first computerized means 2 comprise a first communications module 21, which comprises for example a first modem, suitable to handle automatically the remote exchange of data/information with a remote station, by virtue of the first communications network 4. The first communications network 4 can be constituted by the Internet communications network and/or by a telephone and/or satellite communications network.

Furthermore, the first computerized means 2 comprise a second communications module 22, which comprises for example a second modem, that is connected to the first communications module 21. The second communications module 22 is suitable to automatically handle the exchange of

data/information with the control unit 101 of the field device 100. This can occur by virtue of a standard interface (COM1 or RS232 interface) or by means of a proprietary interface, typically a FIELDBUS interface.

The first computerized means 2 can be located nearby (particularly if a HART communications protocol is used) or remotely with respect to the field device 100 (particularly if a FIELDBUS communications protocol is used).

The computerized system 1 furthermore comprises second computerized means 5, which comprise for example a second appropriately configured computer, linked to the first computerized means 5 by virtue of the first communications network 4. Advantageously, furthermore, the second computerized means 5 and the first computerized means 2 are linked so as to constitute an architecture of the client-server type. It is therefore possible to easily implement known communications protocols, for example of the TCP/IP type. The second computerized means 5 comprise a third communications module 51, which comprises for example a third modem, that is suitable to automatically handle the remote exchange of data/information with the first communications module 21.

The particularity of the computerized system 1 according to the present invention consists of the fact that the second computerized means 5 comprise a first diagnostics and configuration module 52 that is linked to said third communications module 51. The first diagnostics and configuration module 52 remotely and automatically manages, by virtue of the third communications module 51 and the first computerized means 2, diagnostics operations and/or configuration operations on the control unit 101 of the field device 100.

The diagnostics operations can comprise, for example, the acquisition and processing of data regarding physical values and/or parameters related to the operation of the field device 100 and/or the acquisition and processing of data regarding physical values and/or parameters related to the execution of tests on

the control unit 101. In practice, the diagnostics operations relate to the acquisition of data/parameters regarding the operating life of the field device 100 both in operating conditions and during the execution of predefined tests.

Likewise, the configuration operations can comprise the acquisition and/or  
5 processing and/or sending of data/commands related to the corresponding operating configuration of the control unit 101. The configuration operations can therefore relate to the acquisition, processing and installation of data/commands suitable to determine the operating setup of the field device 100.

10 The computerized system according to the present invention has an architecture that allows to implement highly advantageous processes for performing the remote configuration and diagnostics of the field device 100.

For example, the customer can activate the first computerized means 2, which by means of the first communications module 21 can send an intervention  
15 request to the second computerized means 5, more specifically, to the third communications module 51. Once the request for intervention has been received by the third communications module 51, the first diagnostics and configuration module can activate a standard diagnostics and configuration procedure, which can be performed automatically directly on the control unit  
20 101. It should be noted that the execution of the diagnostics and configuration operations does not require direct intervention of the customer (who can simply submit the request of intervention) but can be performed fully by the first diagnostics and configuration module 52, which is capable of accessing remotely and automatically the control unit 101 of the field device 100.

25 Advantageously, the computerized system 1 comprises third computerized means 6, which comprise for example a third appropriately configured computer, which are remotely linked to the second computerized means 5 by virtue of the first communications network 4, as shown in Figure 1, or of a third



communications network (not shown).

The third communications network also can be the Internet communications network and/or a telephone and/or satellite communications network.

The third computerized means 6 preferably comprise a fourth communications  
5 module 61, which comprises for example a fourth modem, suitable to handle automatically the remote exchange of data/information with the third communications module 51.

According to a particularly preferred embodiment, the second computerized means 5 comprises an interfacing module 53 that can be accessed by the first  
10 computerized means 2 (by virtue of the first communications module 21 and the third communications module 51) and the third computerized means 6. The interfacing module 53 preferably comprises a plurality of resources, for example databases, application programs, et cetera, that can be shared by the first computerized means 2 and by the third computerized means 6.  
15 Advantageously, furthermore, the first computerized means 2 and/or the second computerized means 5 and/or the third computerized means 6 can respectively comprise user interface modules 23, 54 and 62. This architecture of the computerized system 1 according to the present invention is particularly advantageous, since it allows to perform remotely even complicated diagnostics  
20 and configuration operations. By using the interfacing module 53, the user (who accesses the first computerized means 2) and the supplier (who accesses the third computerized means 6) can in fact use a common platform for data sharing. In this manner the supplier can easily communicate remotely with the client, who in turn can follow step by step the configuration and diagnostics  
25 operations performed by the supplier.

Advantageously, the first computerized means 2 comprise a second diagnostics and configuration module 24, which is connected to the first communications module 21 and the second communications module 22. The second diagnostics

and configuration module 24 is suitable to support the first diagnostics and configuration module 52 during diagnostics operations and/or configuration operations on the field device 100. For example, the second diagnostics and configuration module 24 can be used to “adapt” the commands sent by the first  
5 diagnostics and configuration module 52 to the communications protocol of the field device 100. In order to perform its supporting action in the best possible manner, the first diagnostics and configuration module 52 interacts advantageously with the second diagnostics and configuration module 24, according to a master-slave mode. Thus, for example, the second diagnostics  
10 and configuration module 24 can receive a first packet of commands on the part of the first diagnostics and configuration module 52 and “adapt” this first packet of commands into a second packet of commands that can be executed directly by the field device 100 (by performing, for example, procedures for compression or compilation or the like).

15 According to a preferred embodiment, the computerized system 1 according to the present invention advantageously comprises fourth computerized means 7 which are connected to the first communications module 21. The fourth computerized means advantageously comprise auxiliary computerized devices, for example Webcam devices or the like connected to appropriate modems,  
20 suitable to support remotely the execution of manual testing operations by the user on the field device 100. This solution is particularly advantageous, since it allows the supplier to control/guide remotely the correct installation of the field device 100 or to direct/control the customer in performing field tests. This allows the customer to drastically limit the need for the intervention of  
25 specialized support personnel on the part of the supplier.

In practice it has been found that the computerized system according to the present invention allows to achieve the intended aim and objects.

The computerized system 1 allows, by virtue of the first, second and third

computerized means, to perform remotely and in an automated manner the diagnostics and configuration operations on a field device in a substantially autonomous manner. In this manner, management of the operating life of the field device 100 can be performed by expert personnel without the need for continuous field interventions, at the same time limiting the need for a considerable coordination effort in order to avoid errors and misunderstandings. Furthermore, with relatively modest efforts (both economic and in terms of time) on the part of the customer the supplier can perform continuous monitoring of the operating conditions of the field device and schedule periodic maintenance operations, intervening preemptively before a fault or malfunction occurs. The maintenance operations can be performed automatically, by reconfiguring appropriately the field device.

If required, by using the fourth computerized means 7 the supplier is able to direct/guide remotely the customer in performing particularly complicated diagnostics and configuration operations.

By virtue of the interfacing module 53, the supplier and the customer can easily share/exchange with the customer, remotely and in an automated manner, information/data regarding the management of the operating life of the field device.

Finally, it has been found that the computerized system 1 according to the present invention can be produced easily and at competitive costs. It is in fact relatively easy to implement practically, since it uses in practice a network of computers (provided appropriately) and field communications networks and/or the Internet and/or telephone networks and/or satellite networks.

The computerized system according to the present invention thus conceived is susceptible of numerous modifications and variations, all of which are within the scope of the inventive concept.

All the details may furthermore be replaced with other technically equivalent

elements.

CLAIMS

1. A computerized system for performing remote diagnostics and configuration operations of a field device which comprises a control unit, said computerized system comprising:

5 -- first computerized means, connected to a first communications network and to a second communications network, said first computerized means comprising:

-- a first communications module suitable to automatically handle the remote exchange of data/information with a remote station, by virtue of said first communications network; and

-- a second communications module, linked to said first communications module and suitable to automatically handle the exchange of data/information with the control unit of said field device by virtue of said second communications network:

15 -- second computerized means, which are connected to said first computerized means and comprise a third communications module suitable to automatically handle the remote exchange of data/information with said first communications module by means of said first communications network;

20 characterized in that said second computerized means comprise a first diagnostics and configuration module, which is linked to said third communications module and is suitable to remotely and automatically handle, by virtue of said third communications module and said first computerized means, diagnostics operations and/or configuration operations on the control unit of said field device.

25 2. The computerized system according to claim 1, characterized in that it comprises third computerized means which are remotely linked to said second computerized means and comprise a fourth communications module

suitable to handle automatically the remote exchange of data/information with said first diagnostics and configuration module, by virtue of said first communications network or by virtue of a third communications network.

3. The computerized system according to claim 2, characterized in that said  
5 second computerized means comprise an interfacing module that can be accessed by said first computerized means and by said third computerized means, said interfacing module comprising a plurality of resources that can be shared by said first computerized means and by said third computerized means.
- 10 4. The computerized system according to one or more of the preceding claims, characterized in that said first computerized means comprise a second diagnostics and configuration module connected to said first communications module and said second communications module, said second diagnostics and configuration module being suitable to support said  
15 first diagnostics and configuration module during diagnostics operations and/or configuration operations on the control unit of said field device.
5. The computerized system according to claim 4, characterized in that said first diagnostics and configuration module interacts with said second diagnostics and configuration module according to a master-slave mode.
- 20 6. The computerized system according to one or more of the preceding claims, characterized in that said first communications network and/or said third communications network is an Internet communications network.
7. The computerized system according to one or more of the preceding claims, characterized in that said first communications network and/or said third  
25 communications network is a telephone and/or satellite communications network.
8. The computerized system according to one or more of the preceding claims, characterized in that said second communications network is a field

communications network.

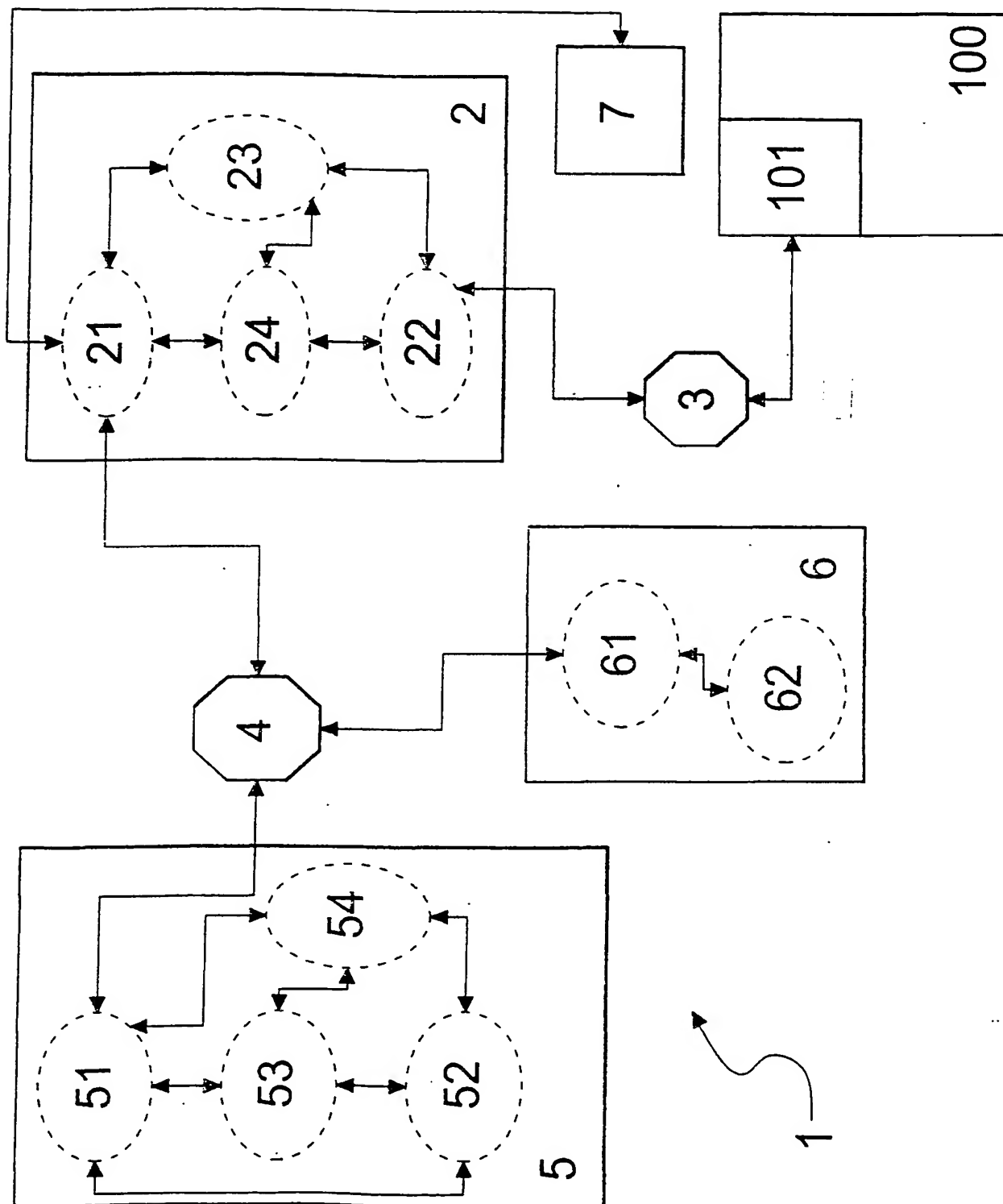
9. The computerized system according to one or more of the preceding claims, characterized in that it comprises fourth computerized means that are suitable to support remotely the execution of manual testing operations on the control unit of said field device.

10. The computerized system according to one or more of the preceding claims, characterized in that said diagnostics operations comprise:

-- the acquisition and processing of data regarding physical values and/or parameters related to the operation of said field device; and/or

-- the acquisition and processing of data regarding physical values and/or parameters related to the execution of tests on said field device.

11. The computerized system according to one or more of the preceding claims, characterized in that said configuration operations comprise the acquisition and/or processing and/or sending of data/commands related to the operating configuration of the control unit of said field device.





(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization  
International Bureau



(43) International Publication Date  
11 July 2002 (11.07.2002)

PCT

(10) International Publication Number  
**WO 02/054162 A3**

(51) International Patent Classification: **G05B 19/042**

(21) International Application Number: **PCT/EP01/14984**

(22) International Filing Date:  
14 December 2001 (14.12.2001)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:  
MI2000A002851  
28 December 2000 (28.12.2000) IT

(71) Applicant (for all designated States except US): **ABB SERVICE S.R.L.** [IT/IT]; Via Arconati, 1, I-20135 Milano (IT).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **CASSARA\***, Salvatore [IT/IT]; Via Martino Anzi, 32, I-22100 Como (IT). **VANINI, Roberto** [IT/IT]; Via Degli Alpini, 20, I-22016 Lenno (IT). **FERRARO, Antonio** [IT/IT]; Via Casanova, 7/A, I-22016 Lenno (IT).

(74) Agent: **GIAVARINI, Francesco**; Zanoli & Giavarini S.r.l., Viale Bianca Maria, 35, I-20122 Milano (IT).

(81) Designated States (national): AE, AL, AU, BA, BB, BG, BR, CA, CN, CU, CZ, DZ, EE, GD, GE, HR, HU, ID, IL, IN, IS, JP, KP, KR, LC, LK, LR, LT, LV, MG, MK, MN, MW, NO, NZ, PL, RO, SG, SI, SK, UA, US, UZ, VN, YU, ZA.

(84) Designated States (regional): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Declaration under Rule 4.17:

— of inventorship (Rule 4.17(iv)) for US only

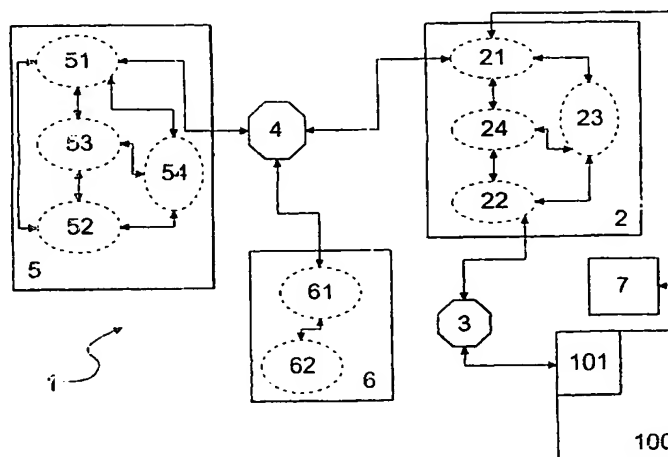
Published:

— with international search report

(88) Date of publication of the international search report:  
4 December 2003

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: **COMPUTERIZED SYSTEM FOR REMOTE DIAGNOSTICS AND CONFIGURATION ON A FIELD DEVICE**



(57) Abstract: A computerized system for performing remote diagnostics and configuration operations of a field device (100) comprising a control unit (101), the system comprising: first computerized means (2) with first and second communications module (21,22) second computerized means (5), which are connected to the first computerized means and comprise a third communications module (51) suitable to automatically handle the remote exchange of data/information with the first communications module (21) its particularity consisting of the fact that the second computerized means (5) comprise a first diagnostics and configuration module (51), which is linked to the third communications module and is suitable to remotely and automatically handle, the virtue of the third communications module and the first computerized means, diagnostic operations and/or configuration operations on the control unit (101) of the field device.

WO 02/054162 A3

## INTERNATIONAL SEARCH REPORT

Inter Application No  
PCT/EP 01/14984

A. CLASSIFICATION OF SUBJECT MATTER  
IPC 7 G05B19/042

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)  
IPC 7 G05B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 980 078 A (CHRISTENSEN DAN D ET AL) 9 November 1999 (1999-11-09) column 16, line 11 -column 22, line 12; figures 11-13	1-11
X	DE 100 07 972 A (FISHER ROSEMOUNT SYSTEMS INC) 19 October 2000 (2000-10-19) page 4, line 19 -page 14, line 20; figures 1-8	1-4, 6, 8-11
X	EP 0 927 933 A (GEN ELECTRIC) 7 July 1999 (1999-07-07) column 2, line 56 -column 5, line 34; figures 1-3	1, 4-7, 10, 11
A	EP 0 965 897 A (NELES CONTROLS OY) 22 December 1999 (1999-12-22) abstract	1-11
	--- -/-	



Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

## \* Special categories of cited documents :

- \*A\* document defining the general state of the art which is not considered to be of particular relevance
- \*E\* earlier document but published on or after the international filing date
- \*L\* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- \*O\* document referring to an oral disclosure, use, exhibition or other means
- \*P\* document published prior to the international filing date but later than the priority date claimed

- \*T\* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- \*X\* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- \*Y\* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- \*G\* document member of the same patent family

Date of the actual completion of the international search

17 March 2003

Date of mailing of the international search report

25/03/2003

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2  
NL - 2280 HV Rijswijk  
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,  
Fax: (+31-70) 340-3016

Authorized officer

Tran-Tien, T

## INTERNATIONAL SEARCH REPORT

International Application No

PCT/EP 01/14984

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 6 098 116 A (CHRISTENSEN DAN D ET AL) 1 August 2000 (2000-08-01) abstract ---	1-11
A	US 5 311 562 A (PALUSAMY SAM S ET AL) 10 May 1994 (1994-05-10) abstract ---	1-11
A	US 6 023 507 A (WOOKEY MICHAEL J) 8 February 2000 (2000-02-08) abstract -----	1-11

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

## INTERNATIONAL SEARCH REPORT

Information on patent family members

Inte \_ \_ \_ \_ \_ Application No

PCT/EP 01/14984

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 5980078	A	09-11-1999	AU 6045498 A	08-09-1998
			AU 6045598 A	08-09-1998
			AU 6252198 A	08-09-1998
			DE 19882113 T0	27-01-2000
			DE 19882117 T0	27-01-2000
			GB 2336446 A , B	20-10-1999
			GB 2336977 A , B	03-11-1999
			GB 2336923 A , B	03-11-1999
			JP 2001512593 T	21-08-2001
			JP 2001512598 T	21-08-2001
			JP 2001512599 T	21-08-2001
			WO 9836353 A1	20-08-1998
			WO 9836336 A1	20-08-1998
			WO 9836335 A2	20-08-1998
DE 10007972	A	19-10-2000	US 6298454 B1	02-10-2001
			DE 10007971 A1	26-10-2000
			DE 10007972 A1	19-10-2000
			DE 10008020 A1	24-08-2000
			GB 2347232 A	30-08-2000
			GB 2347233 A	30-08-2000
			GB 2347234 A	30-08-2000
			JP 2000250619 A	14-09-2000
			JP 2000305620 A	02-11-2000
			JP 2001022430 A	26-01-2001
			US 2002010562 A1	24-01-2002
			US 2002077711 A1	20-06-2002
EP 0927933	A	07-07-1999	US 6175934 B1	16-01-2001
			AU 755197 B2	05-12-2002
			AU 9522498 A	01-07-1999
			EP 0927933 A2	07-07-1999
			JP 11234222 A	27-08-1999
EP 0965897	A	22-12-1999	FI 981406 A	18-12-1999
			DE 965897 T1	17-08-2000
			EP 0965897 A1	22-12-1999
			US 6317701 B1	13-11-2001
US 6098116	A	01-08-2000	NONE	
US 5311562	A	10-05-1994	NONE	
US 6023507	A	08-02-2000	NONE	